

*1 claim is my invention*  
~~New Patent Claims~~

420 Rec'd PCT/PTO 29 SEP 1999

- July 29*
1. Method for forming a first commutative checksum (KP1) for digital data which are grouped into a number of data segments ( $D_i$ ,  $i = 1 \dots n$ ), by a computer,
    - a) in which a segment checksum ( $PS_i$ ) is formed for each data segment ( $D_i$ ),
    - b) in which the first commutative checksum (KP1) is formed by a commutative operation ( $\oplus$ ) on the segment checksums ( $PS_i$ ), and
    - c) in which the first commutative checksum (KP1) is cryptographically protected by using at least one cryptographic operation.
  2. Method for checking a predetermined cryptographic commutative checksum which is allocated to digital data which are grouped into a number of data segments, by a computer,
    - a) in which the cryptographic commutative checksum is subjected to an inverse cryptographic operation to form a first cryptographic checksum (KP1),
    - b) in which a second segment checksum ( $PS_j$ ) is formed for each data segment ( $D_j$ ,  $j = a \dots z$ ),
    - c) in which a second commutative checksum (KP2) is formed by a commutative operation ( $\oplus$ ) on the second segment checksums ( $PS_j$ ), and
    - d) in which the second commutative checksum (KP2) is checked for a match with the first commutative checksum (KP1).
  3. Method for forming and checking a first commutative checksum (KP1) for digital data which are grouped into a number of data segments ( $D_i$ ,  $i = 1 \dots n$ ), by a computer,
    - a) in which a segment checksum ( $PS_i$ ) is formed for each data segment ( $D_i$ ),

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- b) in which the first commutative checksum (KP1) is formed by a commutative operation ( $\oplus$ ) on the segment checksums (PSi),
- c) in which the first commutative checksum (KP1) is cryptographically protected by using at least one cryptographic operation, a cryptographic commutative checksum being formed,
- d) in which the cryptographic commutative checksum (KP1) is subjected to an inverse cryptographic operation to form a first reconstructed cryptographic checksum (KP1),
- e) in which a second segment checksum (PSj) is formed for each data segment (Dj, j = a .. z) of the digital data to which the first commutative checksum (KP1) is allocated,
- f) in which a second commutative checksum (KP2) is formed by a commutative operation ( $\oplus$ ) on the second segment checksums (PSj), and
- g) in which the second commutative checksum (KP2) is checked for a match with the first reconstructed commutative checksum (KP1).
4. Method according to one of Claims 1 to 3, in which the segment checksums (PSi, PSj) are formed in accordance with at least one of the following types:
- forming a hashing value,
  - forming CRC codes,
  - using at least one cryptographic one-way function.
5. Method according to one of Claims 1 to 4, in which the cryptographic operation is a symmetric cryptographic method.
6. Method according to one of Claims 1 to 4, in which the cryptographic operation is an asymmetric cryptographic method.

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7. Method according to one of Claims 1 to 6, in which the commutative operation ( $\oplus$ ) exhibits the property of associativity.

8. Method according to one of Claims 1 to 7, in which digital data are protected, the data segments ( $D_i$ ) of which are not tied to an order.

9. Method according to one of Claims 1 to 7, in which digital data are protected which are processed in accordance with a network management protocol.

10. Arrangement for forming a first commutative checksum ( $KP_1$ ) for digital data which are grouped into a number of data segments ( $D_i$ ,  $i = 1 \dots n$ ), by means of an arithmetic and logic unit which is arranged in such a manner that

a) a segment checksum ( $PS_i$ ) is formed for each data segment ( $D_i$ ), and

b) the first commutative checksum ( $KP_1$ ) is formed by a commutative operation ( $\oplus$ ) on the segment checksums ( $PS_i$ ), and

c) the first commutative checksum ( $KP_1$ ) is cryptographically protected by using at least one cryptographic operation.

11. Arrangement for checking a predetermined first commutative checksum which is allocated to digital data which are grouped into a number of data segments, by means of an arithmetic and logic unit which is arranged in such a manner that

a) the cryptographic commutative checksum is subjected to an inverse cryptographic operation to form a first cryptographic checksum ( $KP_1$ ),

b) a second segment checksum ( $PS_j$ ) is formed for each data segment ( $D_j$ ,  $j = a \dots z$ ),

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- c) a second commutative checksum (KP2) is formed by a commutative operation ( $\oplus$ ) on the second segment checksums (PSj), and
- d) the second commutative checksum (KP2) is checked for a match with the first commutative checksum (KP1).
12. Arrangement for forming and checking a first commutative checksum (KP1) for digital data which is grouped into a number of data segments ( $D_i$ ,  $i = 1 \dots n$ ), by means of at least one arithmetic and logic unit which is arranged in such a manner that
- a) a segment checksum (PSi) is formed for each data segment ( $D_i$ ),
- b) the first commutative checksum (KP1) is formed by a commutative operation ( $\oplus$ ) on the segment checksums (PSi),
- c) the first commutative checksum (KP1) is cryptographically protected by using at least one cryptographic operation, a cryptographic commutative checksum being formed,
- d) the cryptographic commutative checksum (KP1) is subjected to an inverse cryptographic operation to form a first reconstructed cryptographic checksum (KP1),
- e) a second segment checksum (PSj) is formed for each data segment ( $D_j$ ,  $j = a \dots z$ ) of the digital data to which the first commutative checksum (KP1) is allocated,
- f) a second commutative checksum (KP2) is formed by a commutative operation ( $\oplus$ ) on the second segment checksums (PSj), and
- g) the second commutative checksum (KP2) is checked for a match with the first reconstructed commutative checksum (KP1).

13. Arrangement according to one of Claims 10 to 12,

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in which the arithmetic and logic unit is arranged in such a manner that the segment checksums (PSi, PSj) are formed in accordance with at least one of the following types:

- 5    - forming a hashing value,  
     - forming CRC codes,  
     - using at least one cryptographic one-way function.
14.    Arrangement according to one of Claims 10 to 13, in which the arithmetic and logic unit is arranged
- 10   in such a manner that the cryptographic operation is a symmetric cryptographic method.
15.    Arrangement according to one of Claims 10 to 13, in which the arithmetic and logic unit is arranged in such a manner that the cryptographic operation is an
- 15   asymmetric cryptographic method.
16.    Arrangement according to one of Claims 10 to 15, in which the arithmetic and logic unit is arranged in such a manner that the commutative operation ( $\oplus$ ) exhibits the property of associativity.
- 20   17.    Arrangement according to one of Claims 10 to 16, in which the arithmetic and logic unit is set up in such a manner that the digital data are protected, the data segments (Di) of which are not tied to an order.
- 25   18.    Arrangement according to one of Claims 10 to 16, in which the arithmetic and logic unit is arranged in such a manner that the digital data are protected which are processed in accordance with a network management protocol.

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